FOREST RESEARCH NOTES

CALIFORNIA FOREST AND RANGE EXPERIMENT STATION
KEITH ARNOLD, DIRECTOR

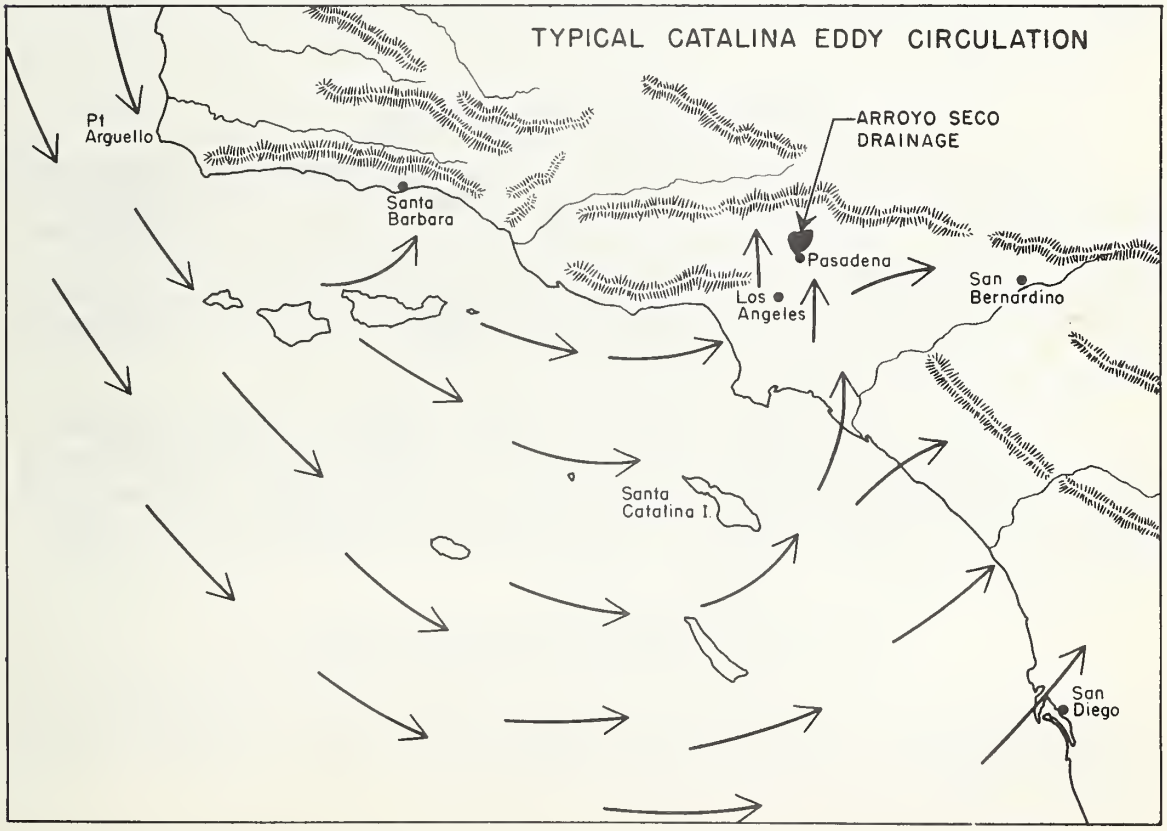
U.S. DEPARTMENT OF AGRICULTURE – FOREST SERVICE

No. 131 November 21, 1957

CATALINA EDDY DISRUPTS WEATHER PATTERN IN THE ARROYO SECO

Mark J. Schroeder, Meteorologist, U. S. Weather Bureau
and Harry C. Coffin, Collaborator, Division of Forest Fire Research

During periods of normal weather fire control men know what action they will take if a fire is reported. They know from experience how the fire will behave. But when the normal weather pattern is disrupted, they may well be at a loss in trying to "out guess" the fire. Fireclimate surveys are bringing to light cases when the weather patterns are anything but normal. Here's an example--



The California Forest and Range Experiment Station is maintained at Berkeley in cooperation with the University of California.

Studies during the past year have shown that the Catalina Eddy circulation can produce weather patterns radically different from those normally experienced during the fire season in the front country of southern California. The Catalina Eddy may be described as a circulation pattern in which the air flows southeast from Point Arguello, then gradually turns toward the east and finally northeast as it reaches the southern California coast. One version of this pattern during the summertime frequently brings a shallow layer of marine air into the coastal areas. Occasionally, however, the Catalina Eddy circulation is intensified by the pressure pattern aloft. When this happens, the southwesterly winds crossing the coastline from Los Angeles to San Diego bring a rather deep layer of marine air into the coastal areas and the front country. The extreme changes that can result are illustrated by the weather patterns observed in the Arroyo Seco from August 21 through 30, 1956.

What happens is this. Drainages such as the Arroyo Seco will be experiencing normal summertime weather. Then the Catalina Eddy circulation begins. It gradually intensifies and deepens, its effects extending over the coastal plains and up the mountain slopes and drainages. Then it weakens and the weather returns to normal. In this case normal weather continued until August 22. Then, from the 23rd through 28th a well-defined Catalina Eddy circulation prevailed. Its maximum effect occurred around the 27th. After that the weather began to return to normal.

NORMAL WIND PATTERN

From a series of 40 wind flow maps of the Arroyo Seco covering the period, 4 were selected to show the change in the wind pattern. Figures 1 and 2 show the wind pattern before the onset of the Catalina Eddy circulation and represent the normal summertime pattern. Shortly after sunrise winds begin to blow upslope. During the forenoon they develop into gusty, light to moderate up-canyon winds which continue until near sunset (fig. 1).

Soon after sunset the nighttime regime begins. As the slopes cool, air begins to flow down the slopes, and during the evening hours down-canyon winds develop. They continue through the night hours as light but steady winds (fig. 2). Fire fighters in mountainous country are familiar with this weather pattern.

CATALINA EDDY WIND PATTERN

The wind pattern during a strong Catalina Eddy circulation can be quite different. Figures 3 and 4 show the extreme changes brought on by the eddy.

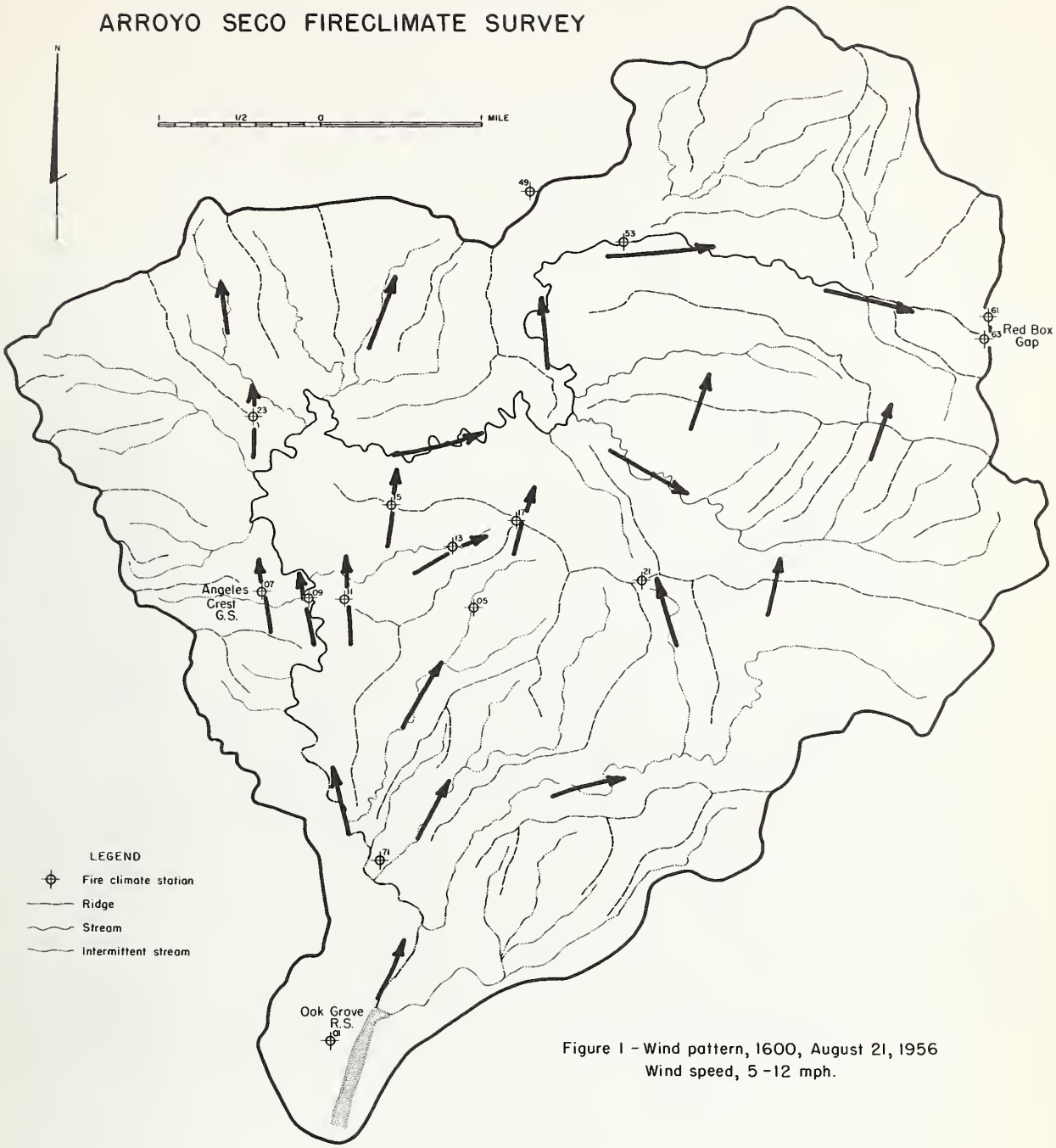


Figure 1 - Wind pattern, 1600, August 21, 1956
Wind speed, 5 - 12 mph.

AGRICULTURE—FOREST SERVICE—SAN FRANCISCO

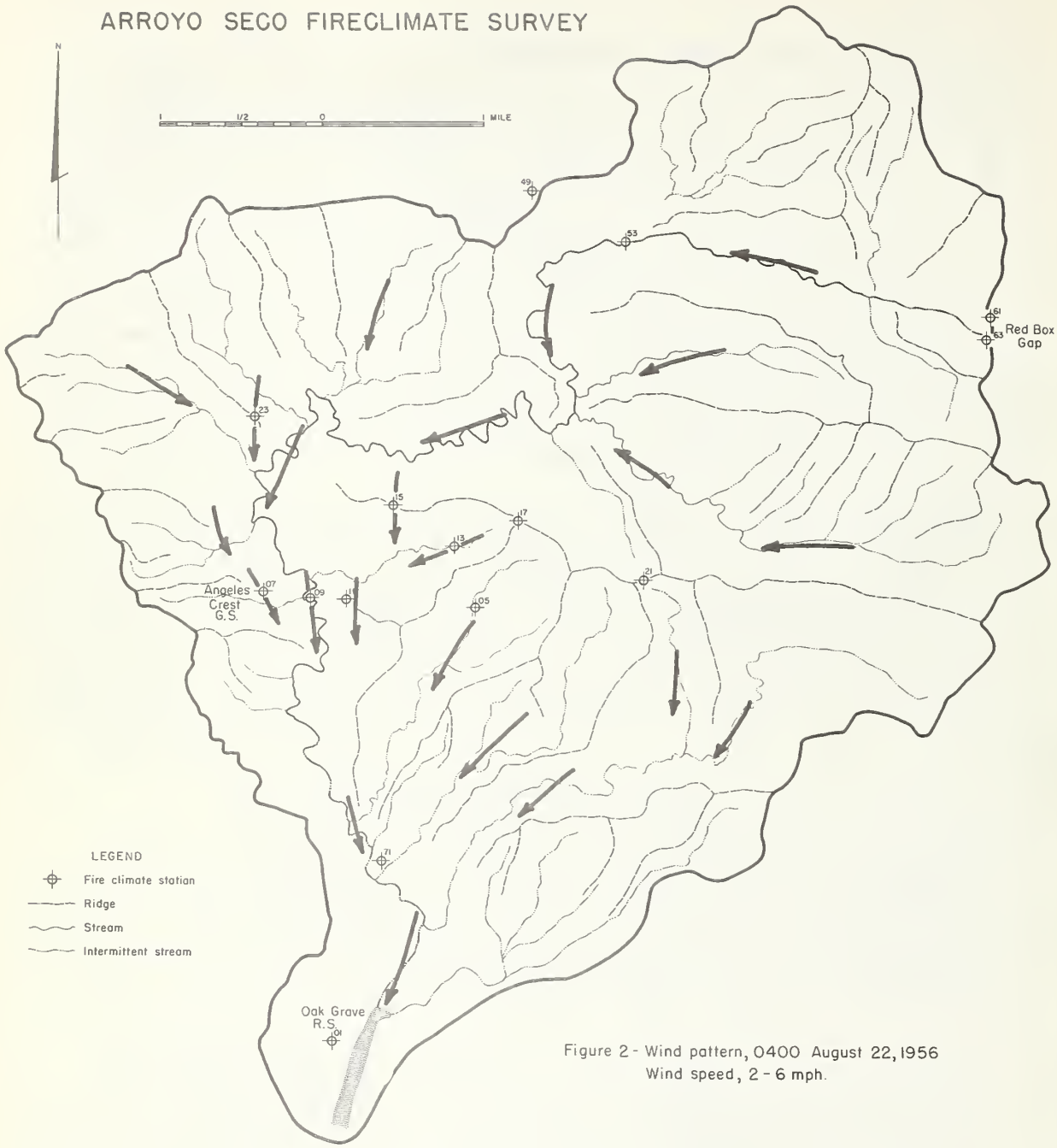


Figure 2 - Wind pattern, 0400 August 22, 1956
Wind speed, 2 - 6 mph.

AGRICULTURE—FOREST SERVICE—SAN FRANCISCO

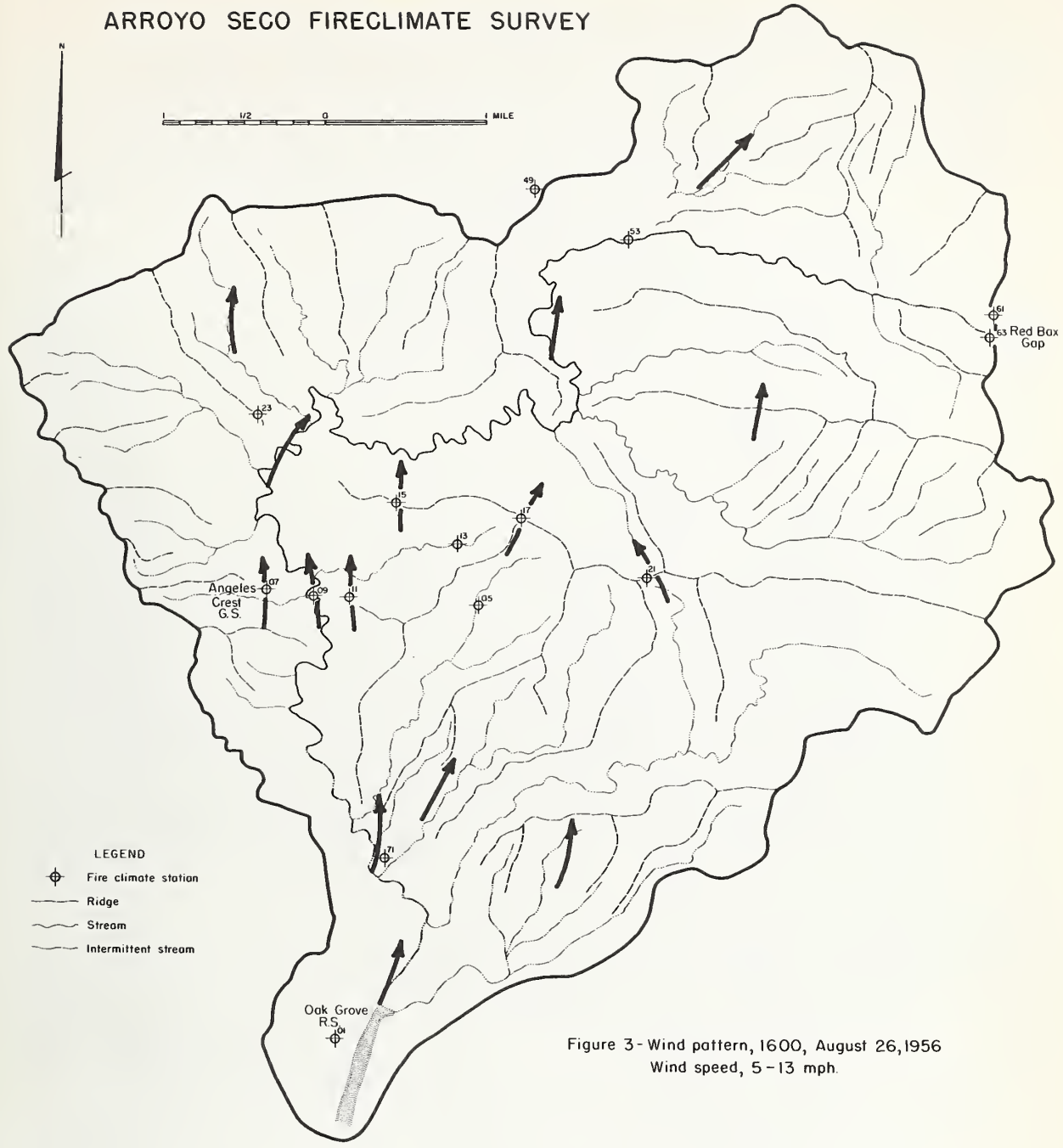


Figure 3 - Wind pattern, 1600, August 26, 1956
Wind speed, 5 - 13 mph.

AGRICULTURE—FOREST SERVICE—SAN FRANCISCO

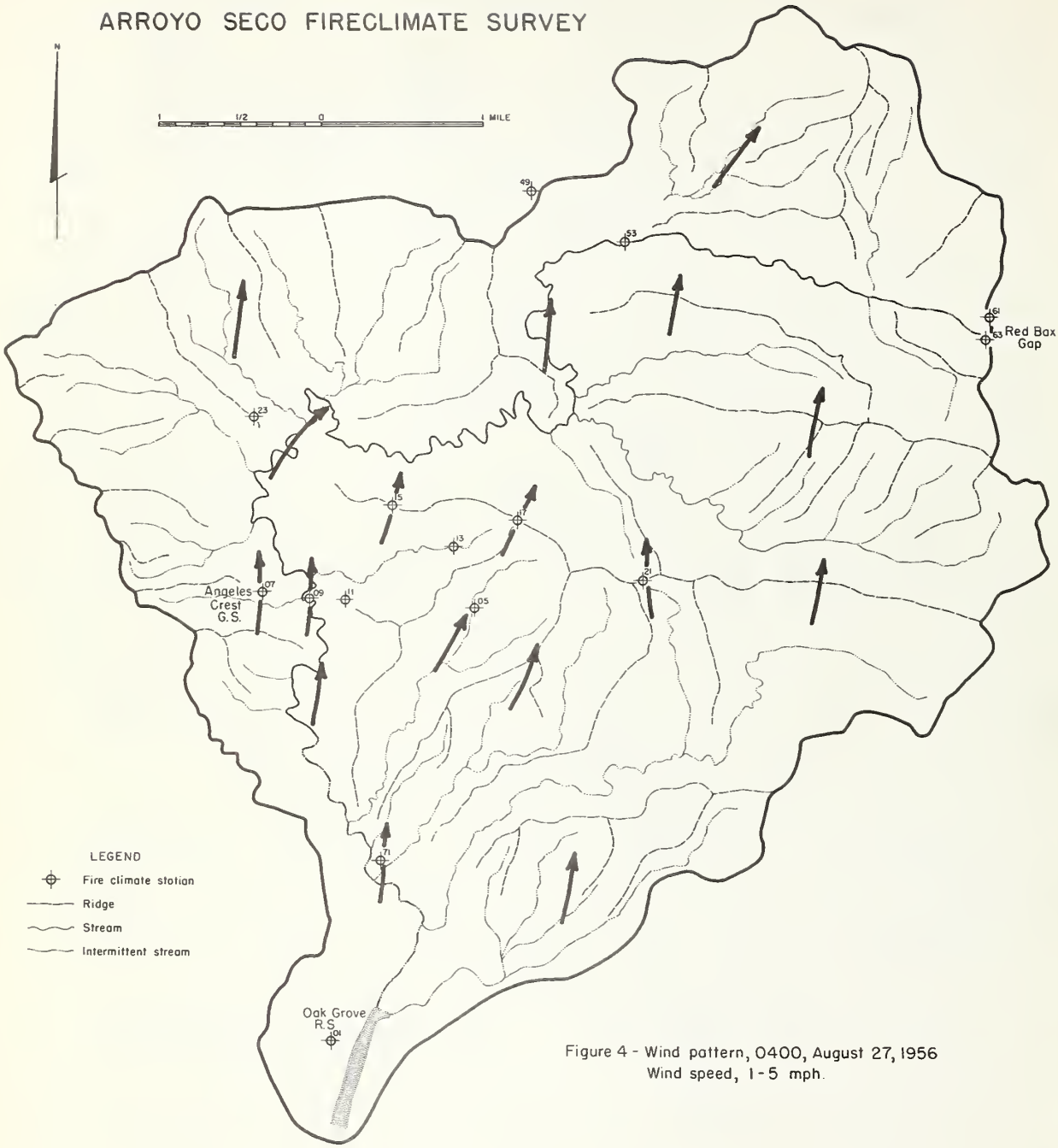


Figure 4 - Wind pattern, 0400, August 27, 1956
Wind speed, 1-5 mph.

AGRICULTURE—FOREST SERVICE—SAN FRANCISCO

The daytime wind pattern (fig. 3) is not appreciably different from the daytime pattern before the eddy sets in. Wind speeds are only slightly higher. There is, however, less tendency for the wind to blow up draws and side canyons that are not oriented north-south. The southerly winds of the eddy bring in cool marine air and frequently stratus clouds. Thus, the daytime heating of slopes is reduced and so are the upslope winds that normally are the result of slope heating.

The nighttime wind pattern (fig. 4) shows a marked change. The wind flow is no longer down-canyon, but is predominantly from the south. In the north-south oriented portion of the drainage this means that an up-canyon wind continues to blow during the night, a complete reversal from the normal pattern. These southerly winds are virtually as strong as the normal down-canyon winds.

TEMPERATURE AND HUMIDITY EFFECTS

During the period of the Catalina Eddy circulation, cool, humid marine air poured into the Arroyo Seco (fig. 5). The 1400 PST and 0400 PST temperatures and relative humidities are shown since these are near the times of the maxima and minima. Both 0400 and 1400 temperatures were highest August 23 except at Red Box Gap (elevation 4,666 feet), which already showed slight cooling by 1400. The lowest 1400 relative humidities at the Angeles Crest station (elevation 2,275) and at Oak Grove Park (elevation 1,060) were recorded on the 23rd. Temperatures continued to fall and humidities continued to rise during the period of the eddy, reaching extremes on the 27th and 28th. It is fortunate for fire fighters that though the Catalina Eddy produces abnormal wind behavior, it also brings cool, humid marine air into coastal drainage and thus reduces the fire danger.

Evidence that the marine layer gradually deepened is found in the reports of stratus cloud tops in the vicinity of the Los Angeles International Airport. On August 24 the tops were at 1,100 feet and the height increased each day, reaching 4,100 feet on the 27th and 4,000 feet on the 28th.

Further evidence of the weather pattern reversal may be noted in the graphs of 0400 temperatures. From the 21st through the 25th the normal nighttime surface temperature inversion was present. The Angeles Crest and Red Box Gap temperatures were higher than the temperature at Oak Grove Park. From the 26th through the end of the period no nighttime surface inversion was present, since the Oak Grove Park temperature was higher than those at the higher elevation stations.

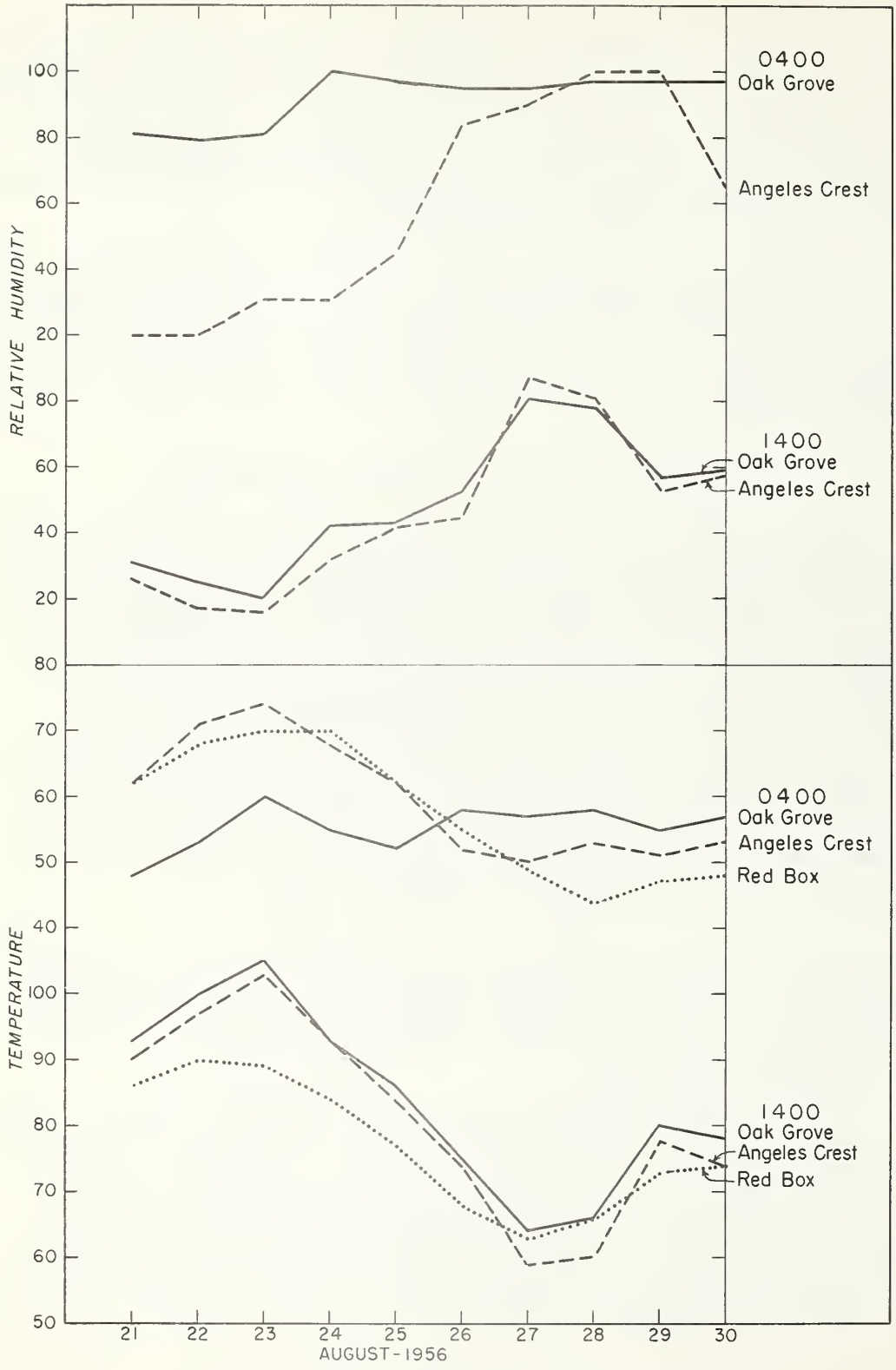


Figure 5 – Trend of 0400 and 1400 relative humidity and temperature at selected stations.

IMPLICATIONS

We have described here what might be considered an extreme weather change brought about by the Catalina Eddy. Certainly the weather changes will not always be as pronounced nor will the marine layer always be as deep. This is especially true if the eddy persists for only 2 or 3 days. However, though the magnitude of the changes may not be as great, the changes will be in the same direction. The nighttime down-canyon winds will be decreased in speed, though the wind direction may not be reversed. Daytime temperatures will become lower and relative humidities will become higher through the layer in which the Catalina Eddy circulation is effective.

The study has not yet revealed any local signs that show a Catalina Eddy circulation is beginning. Weather forecasters in southern California, however, are well aware of this circulation and the fact that a Catalina Eddy is beginning could be included in the fire-weather forecasts.

Though we have described the weather changes only in the Arroyo Seco, it is reasonable to expect similar changes in other drainages on the Angeles National Forest that are oriented more or less north-south and open to the south.